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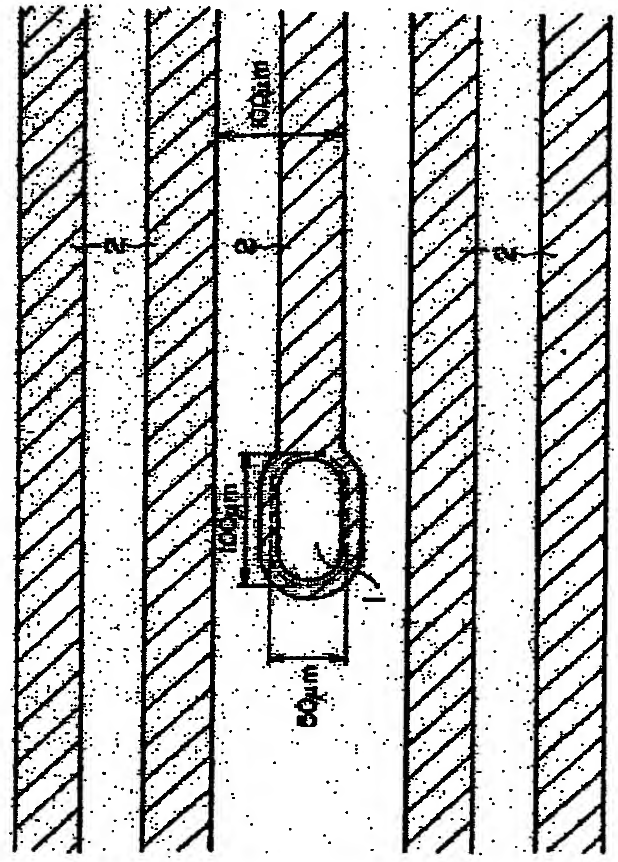

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INVENTOR : KAWANA JUN;

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TITLE : SUBSTRATE FOR SEMICONDUCTOR DEVICE

ABSTRACT : PROBLEM TO BE SOLVED: To secure high connection reliability even with reduction in size of a via by forming the via nearly in a rectangular or elliptical shape.

SOLUTION: A via 1 is formed in such a shape that is elongated in the direction in which there is room to spare to prevent reduction in a connection area of the via 1 itself even with reduction in diameter. The shape of the via 1 is nearly rectangular such as rectangular, rectangular with rounded corners, and elliptical, but preferably is elliptical since a good etching characteristic and a good laser processibility can be achieved. For example, the via 1 is formed in a shape of an ellipse 50 µm wide and 100 µm long, with the longitudinal dimension being twice as long as the transverse dimension. Due to this shape of the via 1, a connection strength and a conductor resistance value of the via 1 can be the same as those of a larger via, thereby obtaining the same wiring density as with a smaller via.

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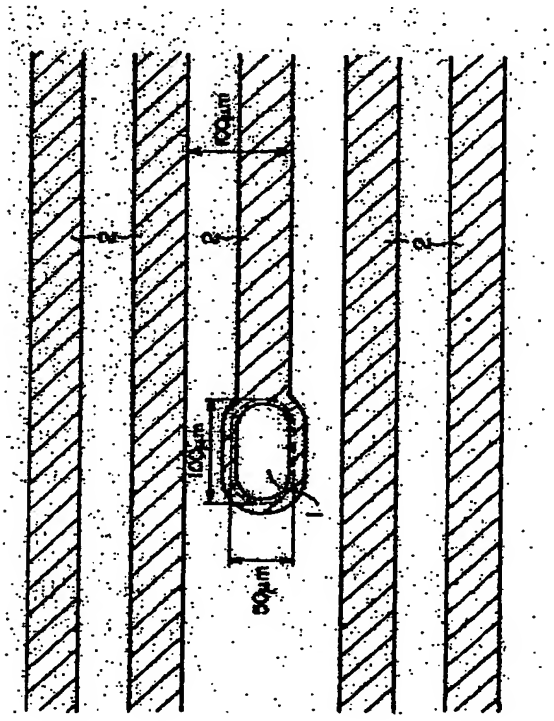
最終頁に続く

(54)【発明の名称】　半導体装置用基板

(57)【要約】
【課題】交互に積み重ねられた複数の配線層と絶縁層を有し絶縁層に設けられたバイアホールを介して絶縁層の上側と下側に配置された配線層が接続されているプリント配線部を備え、かつ、前記プリント配線部上に半導体チップが搭載される半導体装置用基板において、バイアホールの寸法を小さくした場合にも、高い接続信頼性を確保でき、信号の伝搬特性の維持と製造プロセスの安定化を同時に達成可能なバイアホールの構造を提供する。
【解決手段】前記バイアホールが略長方形もしくは長円形であることを特徴とする半導体装置用基板。



【特許請求の範囲】
【請求項１】交互に積み重ねられた複数の配線層と絶縁層を有し絶縁層に設けられたバイアを介して絶縁層の上側と下側に配置された配線層が接続されているプリント配線部を備え、かつ、前記プリント配線部上に半導体チップが搭載される半導体装置用基板において、前記バイアが略長方形もしくは長円形であることを特徴とする半導体装置用基板。
【請求項２】前記略長方形もしくは長円形のバイアの長手方向の向きが、バイアから延伸してなる配線パターンまたは隣接する配線パターンの方向と同一方向であることを特徴とする請求項１に記載の半導体装置用基板。
【請求項３】前記略長方形もしくは長円形が、その短手方向の寸法に対する長手方向の寸法が、１．５～５倍であることを特徴とする請求項１もしくは請求項２に記載の半導体装置用基板。
【請求項４】バイアの上側の配線層がめっきにより形成され、前記バイアの長手方向の径が、バイアの上側の配線層の厚さの２倍以上であり、かつ短手方向の径がバイアの上側の配線層の厚さの２倍以下であり、かつバイアがめっきで充填されていることを特徴とする請求項１乃至請求項３のいずれか一項記載の半導体装置用基板。
【請求項５】交互に積み重ねられた複数の配線層と絶縁層を有し、絶縁層に設けられたバイアを介して絶縁層の上側と下側に配置された配線層が接続されているプリント配線部を備え、かつ、前記プリント配線部上に半導体チップが搭載される半導体装置用基板において、前記バイアが略長方形もしくは長円形の形状の組み合わせであることを特徴とする半導体装置用基板。
【請求項６】前記バイアが導電性材料で充填されていることを特徴とする請求項１乃至請求項３及び請求項５のいずれか一項記載の半導体装置用基板。
【請求項７】前記充填が、めっきで行われていることを特徴とする請求項６記載の半導体装置用基板。
【請求項８】前記めっきが、銅めっきまたはニッケルめっきであることを特徴とする請求項７記載の半導体装置用基板。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ビルドアップ法を用いて製造された半導体装置用基板に係り、特に配線密度が高くなり、バイアの大きさが小さくなった場合にも、接続信頼性と電気特性の良好な半導体装置用基板に関する。
【０００２】
【従来の技術】近年、パーソナルコンピューター等に代表されるように、電子機器に小型化、薄型化が求められている。そのため、内部のプリント配線板にも、小型化、薄型化が求められ、それを実現するために、配線パターンの幅は細く、間隙は小さく、配線層の多層化、配線層間を接続するバイアの小径化という、いわゆる高密度配線が求められている。また、薄型化に伴う薄い絶縁層、薄い配線層を形成するために、薄い絶縁基板や薄い銅箔を用いると、材料コストが上昇する。
【０００３】これらの問題を解決したプリント配線板として、ビルドアップ法を用いたプリント配線板が知られている。この方法は絶縁性基板上に配線パターンを形成し、その上に絶縁層を形成し、さらにその上に配線パターンを形成し、さらに絶縁層を形成するという工程を繰り返すことにより、多層プリント配線板を形成するというものである。このプリント配線板は、リードフレーム上に半導体チップを搭載し、樹脂封止して得られるＩＣパッケージや、抵抗部品、コンデンサ部品等の電子部品を搭載するという、親基板としての用いられ方ばかりでなく、単数、もしくは複数の半導体チップを直接搭載し、ボール・グリッド・アレー（ＢＧＡ）やピン・グリッド・アレー（ＰＧＡ）等の形態で、半導体装置として親基板に搭載される半導体装置用基板としても用いられている。これらの半導体装置はマルチチップモジュール（ＭＣＭ）、シングルチップモジュール（ＳＣＭ）とも呼ばれている。
【０００４】ビルドアップ法を用いたプリント配線板の例を、図５に従って説明する。まず図５（ａ）のように、ガラスエポキシ基板等のリジッドな材料からなる絶縁基板５１上に配線パターン５２を形成する。この場合、両面銅張ガラスエポキシ基板を用いて、エッチングにより配線パターンを形成するという方法が簡易でよい。続いて、図５（ｂ）のように、感光性エポキシ樹脂を塗布し、絶縁層５３を形成し、バイアを形成する部分５４の感光性エポキシ樹脂を露光、現像して取り除く。このように露光、現像工程でバイアを形成することにより、微細なバイアを得ることができる。なお、絶縁層の形成にあたっては樹脂を塗布するという方法が、均一な厚さで簡易に絶縁層を形成できるという点からみて好ましく、塗布方法としてはスクリーン印刷法、カーテンコート法やスピンコート法が適用されている。絶縁層の材料としては他にポリイミド樹脂、アクリル樹脂等が用いられる。なお、上述のように感光性樹脂を用い、露光、現像工程でバイアを形成する方法ではなく、炭酸ガスレーザーや、ＹＡＧレーザー、エキシマレーザー等のレーザーを用いて、絶縁樹脂にバイアを形成する方法を採用してもよい。この場合、絶縁樹脂は感光性材料である必要はない。そして、図５（ｃ）のように、絶縁層５３上に無電解めっき、電解めっきによって銅箔を形成し、バイア５５を設け、形成された銅箔をエッチングすることにより配線パターン５６を形成する。この際、無電解めっきは、絶縁層上に導電性を付与し、電解めっきが可能となるようにするために行うものである。なお、配線パターン形成には、サブトラクティブ法及びアディティブ法のいずれもが適用できる。次に、図５（ｄ）に示すよ

うに、絶縁層５７を全面に形成し、バイア部を露光現像する。形成の方法は、図５（ｂ）の工程で用いた方法と同様でよい。さらに、ドリルを用いてスルーホール用の貫通孔５８を形成する。そして、図５（ｃ）と同様の工程でめっきを行い、バイア５９及びスルーホール６０を形成する（図５（ｅ））。この場合、スルーホール６０は配線パターンの高密度形成の障害とならないように、なるべく孔径が小さいほうが好ましい。続いて、エッチングにより配線パターン６１を形成する。この際に表層配線層を形成した側と反対の面の銅箔も同時にエッチングして、電源層のパターン６２とする。そして、配線パターン６１、電源層のパターン６２を保護するソルダーレジスト６３を設けて、プリント配線板が完成する（図５（ｆ））。以上で説明したような従来から知られているバイアは、平面形状が円形であり、感光性樹脂を使用したいわゆるフォトリソ法で形成したバイアも、レーザー加工法で形成したバイアも、その平面形状は円形であるのが一般的であった。

【０００５】ところで、近年の技術進歩により、配線パターンの寸法はますます縮小する傾向にあり、バイアもより小さなものが求められている。しかし、配線パターンの寸法と比較してバイア部のピッチは大きくせざるを得なかった。バイアの接続信頼性を高めるため、ある程度の大きさの孔をあけ、孔の大きさよりもかなり大きく、ランドの大きさを設定する必要があった。しかし、バイアの寸法を単純に小さくしていくとバイアの断面積はバイアの寸法（半径）の２乗で小さくなる。そして、ビルドアップ法においては、バイアと下側の配線層の間の接続は、バイアの底面と、下側配線層の上面によって行われる。そのため、バイア部における上下層の導通を安定して確保することはますます難しくなっている。すなわち、熱衝撃試験等の信頼性試験や部品実装時や使用時の発熱により、絶縁層の厚み方向で伸縮が発生する。この時のバイア上下層の接続強度は、バイアの断面積にほぼ比例するため、従来のようにバイアの寸法が大きければ問題ない場合にも、バイアの寸法を小さくしていくと十分な接続強度を保てなくなってきている。さらに、バイアの抵抗値の増大は信号の伝搬特性に影響を及ぼし、その周波数が高いほど影響は顕著になる。また、バイアの寸法が小さいと、バイア内にめっきが析出しにくくなったり、レジストパターン形成が難しくなるなど、製造上の問題点も出てくる。

【０００６】

【発明が解決しようとする課題】本発明はこのような問題点に着目してなされたもので、その課題とするところは、バイアの寸法を小さくした場合にも、高い接続信頼性を確保でき、信号の伝搬特性の維持と製造プロセスの安定化を同時に達成可能なバイアの構造を提供することであり、従って、高密度の配線パターンが、高い信頼性で、また優れた信号の伝搬特性を有し、さらに安定して製造可能な、半導体装置用基板を提供することにある。

【０００７】

【課題を解決するための手段】本発明はかかる課題を解決するものであり、請求項１の発明は、交互に積み重ねられた複数の配線層と絶縁層を有し絶縁層に設けられたバイアを介して絶縁層の上側と下側に配置された配線層が接続されているプリント配線部を備え、かつ、前記プリント配線部上に半導体チップが搭載される半導体装置用基板において、前記バイアが略長方形もしくは長円形であることを特徴とする半導体装置用基板としたものである。

【０００８】本発明の請求項２の発明は、前記略長方形もしくは長円形のバイアの長手方向の向きが、バイアから延伸してなる配線パターンまたは隣接する配線パターンの方向と同一方向であることを特徴とする請求項１に記載の半導体装置用基板としたものである。

【０００９】本発明の請求項３の発明は、前記略長方形もしくは長円形が、その短手方向の寸法に対する長手方向の寸法が、１．５～５倍であることを特徴とする請求項１もしくは請求項２に記載の半導体装置用基板としたものである。

【００１０】本発明の請求項４の発明は、バイアの上側の配線層がめっきにより形成され、前記バイアの長手方向の径が、バイアの上側の配線層の厚さの２倍以上であり、かつ短手方向の径がバイアの上側の配線層の厚さの２倍以下であり、かつバイアがめっきで充填されていることを特徴とする請求項１乃至請求項３のいずれか一項記載の半導体装置用基板としたものである。

【００１１】本発明の請求項５の発明は、交互に積み重ねられた複数の配線層と絶縁層を有し、絶縁層に設けられたバイアを介して絶縁層の上側と下側に配置された配線層が接続されているプリント配線部を備え、かつ、前記プリント配線部上に半導体チップが搭載される半導体装置用基板において、前記バイアが略長方形もしくは長円形の形状の組み合わせであることを特徴とする半導体装置用基板としたものである。

【００１２】本発明の請求項６の発明は、前記バイアが導電性材料で充填されていることを特徴とする請求項１乃至請求項３及び請求項５のいずれか一項記載の半導体装置用基板。

【００１３】本発明の請求項７の発明は、前記充填が、めっきで行われていることを特徴とする請求項６記載の半導体装置用基板としたものである。

【００１４】本発明の請求項８の発明は、前記めっきが、銅めっきまたはニッケルめっきであることを特徴とする請求項７記載の半導体装置用基板としたものである。

【００１５】

【発明の実施の形態】本発明の半導体装置用基板を実施形態に基づき以下に詳細に説明する。すなわち、請求項

1に係る発明は、バイアの径を小さくしてもバイア自体の接続面積を小さくさせないために、スペースに余裕のある方向に長くした形状のバイアを形成しようとするものである。このことによってバイア部の接続強度と導体抵抗値をより大きなバイアと同等に保ちつつ、バイアを小さくした場合と同等の配線密度を得られる。また、バイアのめっきやエッチングといったプロセス上においても、一回り大きなバイアと同等の安定性を得ることができる。バイアの形状として長方形、隅の角部を丸めた長方形、長円形等の略長方形が利用できるが、エッチング特性やレーザー加工性が良好な点から、又メッキの際に、長方形の隅の角部にメッキ液が入り込みにくいことから、隅の角部を丸めた長方形が好ましく、さらに好適には長円形の形状が利用できる。

【００１６】そして請求項２記載の発明では、バイアで上の配線層から下の配線層へ接続するとき、配線の方向とバイアの長手方向が同じ場合には、この方向のスペースは多くの場合余裕があり、バイアを長くしても比較的に配線密度を低下させることはない。また、配線密度が高い場合には、バイアに隣接して複数の配線が平行に走っているため、すくなくともこの配線層においては配線の方向とバイアの長手方向を一致させることは、バイアによる配線密度低下防止に有効である。図１は本発明の１実施例であるが、図に示すように、本発明のような幅約５０μｍ長さ１００μｍのバイアは配線ピッチが１００μｍのパターンの配線密度に影響することなく配置できるが、従来のφ１００μｍバイアをここにそのまま入れようとすると図３に示したように、両隣の２本の配線が形成できなくなり、配線密度は著しく低下してしまう。また、配線ピッチを少々広げて最適化しても約１本分の配線が形成できないことになる。

【００１７】次に請求項３に記載の発明では、バイアとして利用できる大きさを示したものである。即ち、その短手方向の寸法に対する長手方向の寸法比は、１．５～５倍のものが利用できる。短手方向の寸法に対して、１．５倍以下であると、円形のものと同等の接続信頼性しか、期待できない。また、５倍以上であると、面積が大きくなりすぎ、配線密度が低下する。一般に絶縁層の上側と下側の層は、配線効率を高めるため、主となる配線方向が、互いに直交するように配線するので、５倍以上になると、短手方向の配線の流れを著しく阻害することになる。

【００１８】次に請求項４に記載の発明では、バイアとして利用できる大きさをバイア上側の配線層の厚さで示したものである。即ち、バイアの上側の配線層がめっきにより形成され、その長手方向の寸法がバイア上側の配線層の厚さの２倍以上であり、その短手方向の寸法がバイア上側の配線層の厚さの２倍以下である。そして、さらにバイアがめっきで充填されているものである。長手方向の寸法がバイア上側の配線層の厚さの２倍以上に設定しているため、高い接続信頼性で接続を行うことができ、短手方向の寸法がバイア上側の配線層の厚さの２倍以下であるために高い密度の配線を可能にし、さらにバイア内部を確実にめっきで充填することができる。

【００１９】次に請求項５の発明では、バイアで上の配線層から下の配線層へ接続するとき、上の配線層と下の配線層が平行でない場合、バイアの形状をそれぞれの配線層に平行な略長方形または長円形のバイアを組み合わせた形にしておくことにより、配線密度の低下を防ぐことが出来る。

【００２０】次に請求項６～８の発明では、バイアを導電性物質で埋め込むことにより、表面が平滑になり、ファインパターン形成やその上にレジストを形成するのが容易である。また、バイアの接続強度が高まり、導体抵抗が減少して接続信頼性が高まる。さらに、バイアの上にバイアを重ねて形成することにより、設計の自由度が向上する。

【００２１】本発明は以上のような内容であるから、バイアの寸法を小さくした場合にも、高い接続信頼性を確保でき、信号の伝搬特性の維持と製造プロセスの安定化を同時に達成可能なバイアの構造とする作用を有する。

【００２２】

【実施例】次に、本発明の具体的実施例を図面を参照して以下に詳細に説明する。

【００２３】＜実施例１＞この実施例の半導体装置用基板は、幅５０μｍ、長さ１００μｍの長円形のバイアを有しており、バイアの短手方法の寸法に対する長手方向の寸法の比は２倍となっているものである。そして、この半導体装置用基板は図５に示すような工程を経て製造されたものである。

【００２４】まず、ガラスーエポキシ樹脂の表面に厚さ１８μｍの銅箔を貼り付けた厚さ１．２ｍｍの銅張積層板（三菱ガス化学（株）製 商品名ＣＣＬ－ＥＬ１７０）の表面を洗浄し、この後の工程で銅箔に配線パターンを形成するためのエッチングレジストとなるドライフィルム（日立化成工業（株）製 商品名フォテック）を貼り合わせた。所望の配線のネガパターンを形成したマスクフィルムを重ね合わせ、露光・現像し、銅箔上にエッチングレジストパターンを形成した。塩化第二鉄溶液をスプレーで吹き付け、露出した銅箔部分を溶解させて除去した。水酸化ナトリウム溶液をスプレーで吹きつけ、エッチングレジストを完全に剥離した。以上の工程を経て、ガラスーエポキシ樹脂基板上に最下層となる配線パターンを形成した。

【００２５】次に、配線パターンとこの後に形成する絶縁樹脂との密着性を高めるために、黒化処理と呼ばれる処理を施して配線パターン表面に酸化銅の皮膜を形成した。スクリーン印刷法によって感光性樹脂インキ（（株）アサヒ化学研究所製 商品名ＤＰＲ－１０５）を厚さ約３０μｍとなるように印刷し、乾燥させた。幅

５０μｍ、長さ１００μｍの長円形のバイアとなる黒点を有するマスクフィルムを重ねて露光した後、１、１、１－トリクロロエタンをスプレーで吹き付けて光の当たらなかった幅５０μｍ、長さ１００μｍの長円形の部分を除去した。

【００２６】なお、バイアが従来のような円形の場合、φ８０μｍ程度であれば残滓がなくきれいに現像できるが、φ５０μｍ程度になると、現像液が内部に入りにくいため底まで現像され難く、すべてのバイアが導通不良となっていた。すなわち、この絶縁樹脂のこの条件の解像限界は５０～８０μｍになる。そこで、本発明のようにバイアを幅５０μｍ、長さ１００μｍの長円形にすることによって、バイアの短手方向が解像限界値以下においても、長手方向がそれより十分大きければバイアの底に残滓が残らずに現像可能になる。以上の工程によって、長円形のバイアとなる樹脂の窪みを形成した。

【００２７】さらに、１３０度で約６０分間ベーキングして樹脂を硬化させた後、過マンガン酸溶液で処理して樹脂表面を粗化し、無電解銅めっき、電解銅めっきを順に行い、絶縁樹脂表面全面とバイア内に厚さ約２０μｍの銅の皮膜を形成した。その後、最下層の配線パターン形成と同じ製造工程を経ることによって、２層目の配線パターンを形成した。以上の工程で本発明の半導体装置用基板を得た。

【００２８】＜実施例２＞この実施の形態に係る半導体装置用基板は、幅３０μｍ、長さ６０μｍの長円形のバイアを有しており、バイアの短手方法の寸法に対する長手方向の寸法の比は２倍となっているものである。そして、この半導体装置用基板は図５に示すような工程を経て製造されたものである。

【００２９】まず、ガラスーエポキシ樹脂の表面に厚さ１８μｍの銅箔を貼り付けた厚さ０．４ｍｍの銅張積層板（三菱ガス化学（株）製商品名ＣＣＬ－ＥＬ１７０）にφ３００μｍの穴をあけ、メッキして表裏を導通させた。表面を洗浄し、この後の工程で銅箔に配線パターンを形成するためのエッチングレジストとなるドライフィルム（日立化成工業（株）製商品名フォテック）を貼り合わせた。所望の配線のネガパターンを形成したマスクフィルムを重ね合わせ、露光・現像し、銅箔上にエッチングレジストパターンを形成した。塩化第二鉄溶液をスプレーで吹き付け、露出した銅箔部分を溶解させて除去した。水酸化ナトリウム溶液をスプレーで吹きつけ、エッチングレジストを完全に剥離した。以上の工程を経て、ガラスーエポキシ樹脂基板上に最下層となる配線パターンを形成した。

【００３０】次に、配線パターンとこの後に形成する絶縁樹脂との密着性を高めるために、黒化処理と呼ばれる処理を施して配線パターン表面に酸化銅の皮膜を形成した。カーテンコート法によって感光性樹脂インキ（日本チバガイギー製商品名プロビマー５２）を厚さ約５０μｍとなるように印刷し、乾燥させた。バイアとなる部分以外の比較的大きなパターンを形成するため、この部分を遮光するパターンを有するマスクフィルムを重ねて露光した後、プロビマー現像液をスプレーで吹き付けて光の当たらなかった部分の樹脂を除去した。１００℃で３０分ベーキングした後、さらに温度を１３０℃に上げ６０分間ベーキングして樹脂を硬化させた後、表面をバフ研磨して表面の凹凸と現像で発生したひさしと露光によって発生した硬い皮膜を除去した。

【００３１】次に、紫外線レーザー加工機（ＥＳＩ製商品名モデル５１００レーザー加工装置）で幅３０μｍ、長さ６０μｍのバイアとなる窪みを形成した。この時、ビーム径φ３０μｍのレーザーを幅６０μｍの範囲で振りながら加工して目的の形状を得た。このように、バイア以外の加工を別に実施したのは、この感光性樹脂インキは解像性が劣るためφ１００～１２５μｍ程度のバイアしか形成できないのに対し、紫外線レーザー加工機はφ３０～５０μｍ程度の小さな穴の加工に適しているため、本実施例のように極小径バイアと１５０μｍ程度のバイアやそれ以上の大きさのパターンの両方を有するものにはフォトリソ法とレーザー加工法の組み合わせが有益である。

【００３２】さらに、過マンガン酸溶液で処理して樹脂表面を粗化し、無電解銅めっき、電解銅めっきを順に行い、図４に示すような絶縁樹脂表面全面に厚さ１５μｍ、バイア内には１０～１３μｍの銅の皮膜を形成した。

【００３３】なお、従来のφ３０μｍバイアを同じ条件でめっきすると、バイア内には２～７μｍしかめっきがつかないうちにバイアの上部のめっき被膜が厚くなり、入り口部分が塞がってしまうため、バイアの信頼性は著しく劣ったものでしかなかった。このようにバイアを真円から長円形にすることで、特に、φ３０μｍ程度の極小径バイアの接続信頼性は大幅に改善した。その後、最下層の配線パターン形成と同じ製造工程を経ることによって、片側にフリップチップ搭載用パッドを有するパターンを、反対側にはんだボールを形成するためのマトリックス状のランドを有する２層目の配線パターンを形成した。以上の工程で本発明の半導体装置用基板を得た。

【００３４】＜実施例３＞この実施例の半導体装置用基板は、幅５０μｍ、長さ８０μｍの長円形のバイアを有しており、バイアの短手方向の寸法に対する長手方向の寸法の比が１．６倍となっているものである。そして、この半導体装置用基板は図５に示すような工程を経て製造されたものである。

【００３５】まず、両面に１８μｍの銅箔を貼りつけた厚さ約０．６ｍｍの銅張積層板（三菱ガス化学（株）製、商品名ＣＣＬ－ＥＬ１７０）の表面を硫酸と過酸化水素を主成分とする液で洗浄し、水洗後すぐに約８０℃の乾燥エアーを吹き付けて、汚れがなく表面状態が均一

な状態にした。この後の工程で銅箔に配線パターンを形成するためのエッチングレジストとなる厚さ４０μｍのドライフィルム（日立化成工業（株）製商品名フォテック）を両面に貼り合わせた。所望の配線のネガパターンを形成したガラスマスクを重ね合わせ、紫外線を照射することにより被照射部のドライフィルムレジストが現像液で溶解しにくい状態にした後、炭酸ナトリウムを含有する現像液をスプレーで吹き付け、紫外線の当たらなかった部分のレジストを除去して、所望の配線パターンと同一のドライフィルムレジストのパターンを形成した。約５０℃の塩化第二銅溶液を吹き付けて露出した銅箔部分を溶解除去し、次いで、約５０℃の５％水酸化ナトリウム溶液をスプレーで吹き付けてドライフィルムレジストを剥離することにより最下層の配線パターンを形成した。

【００３６】次に、黒化処理を行って配線パターン表面に酸化銅の皮膜を形成した。スクリーン印刷によって感光性樹脂インキ（太陽インキ製造（株）製、商品名ＰＳＲ－４０００）を約４０μｍの厚さになるように印刷し、表面がベトつかない程度にオーブンで乾燥させ室温に戻るまで放置した。長さ８０μｍ、幅５０μｍの長円形の非透過パターンを有するマスクを位置合わせして重ね合わせ、露光量が５００～８００ｍＪ／ｃｍ²になるように紫外線を照射した。なお、このとき使用したマスクは石英ガラス上にクロムの遮光パターンが形成されたものを使用した。安価なエマルジョンのガラスマスクやフィルムマスクを使用して、長さ８０μｍ、幅５０μｍの長円形のパターンを安定して解像することは、マスク性能上から難しい。そして、炭酸ナトリウム溶液で現像してバイアとなる樹脂の凹部を形成した。

【００３７】そして、１３０℃のオーブンに１２０分間入れて樹脂を硬化させた後、過マンガン酸カリウム溶液で樹脂表面を粗化してめっきの密着性の良い均一で微細な樹脂の凹凸を形成した。この時点でバイア底に樹脂の残渣のない良好な銅表面の安定した露出が確認できた。従来のように通常の円形バイアを形成しようとするとφ５０μｍはもちろん、φ８０μｍでも安定してバイアとなる凹部を形成することができなかったが、石英ガラス上にクロムの遮光パターンが形成された高品質マスクを使用し、バイアを長円形にすることによって可能になった。このように感光性樹脂の解像度限界値付近のバイアを解像する場合、バイアの短軸方向が解像度限界値程度の寸法であってもバイアの長軸方向の寸法を円形バイアの解像可能なバイア径まで大きくすることと、パターンのエッジが鮮明で遮光性に優れた遮光部と透過率の高い透過部を有する高品質マスクを使用することで、解像性とその安定性が大幅に向上した。

【００３８】次に、無電解めっき、電解めっきを順に行い、樹脂表面に約２３μｍの銅の皮膜を形成した。このとき、感光性樹脂を除去した凹部は銅めっきで完全に埋められ、フィルドバイアと呼ばれる表面が平滑の状態になった。従来のように円形バイアを形成しようとした場合、φ８０μｍのバイアではめっきが埋まりきれず表面に凹部が残り、完全なフィルドバイアを得ることができなかった。つまり、バイアをめっきで埋めようとした場合、めっき条件や凹部の深さ、そして表面めっき厚設定値等にもよるが、表面めっき厚の２～３倍またはそれ以上の径になるとバイアを完全に埋めることは難しい。例えば、凹部の深さを３０～４０μｍ、バイア径をφ８０μｍ以上、表面めっき厚を１０～２０μｍとすると、バイアを埋め込もうとしてめっきしても凹部が残ってしまった。逆に、この条件でバイアを埋め込むには、バイア径をφ６０μｍ程度またはそれ以下にしなければならなかったり、表面めっき厚をおよそ４０μｍ以上（より安全を見ると６０μｍ以上）に厚くしなければならなかった。そうなると、φ５０μｍなど、φ８０μｍ以下の凹部を安定して形成することが難しくなったり、導体幅５０μｍ程度の微細な回路の形成が困難になるという問題があった。

【００３９】一方、本発明では例えばφ８０μｍの円形バイアを形成する代わりに、長径８０μｍ、短径５０μｍの長円形のバイアを形成することにより、埋め込まなければならない凹部の体積や短径方向の断面積が減少し、凹部自体が埋め込みに有利な形状になるため、表面めっき厚を増加させずに埋め込めるようになる。

【００４０】なお、めっきで埋め込めるかどうかは、凹部が円形の場合、表面と凹部に均一なめっきをつけた時の凹部のめっき体積と凹部そのものの体積との比でだいたい決まる。この比が１：１なら計算上通常のめっきでも埋まることになるが、穴埋めめっきでは１：１．５～１：２程度の比でも凹部を埋めることができる。それに加えて凹部を長円形にした場合、凹部の体積よりも短径のバイア断面積が埋め込み条件として優勢になるため、短径とほぼ同じ径の円の条件で埋め込むことができる。そのため、穴埋めめっきと長円形バイアの組み合わせはバイア断面積を十分に確保した状態でバイアの埋め込みが出来るため、メリットが大きい。

【００４１】その後、最下層の配線パターン形成と同じ製造工程を経ることによって、２層目の配線パターンを形成し、さらに上記絶縁層・バイアの形成と同じ製造工程、次いで、最下層の配線パターン形成と同じ製造工程を再び経ることによって、２層目の絶縁層・バイアと３層目の配線パターンを形成した。最後に表面の配線パターンを保護するための樹脂膜（ソルダーレジスト）を形成した。以上の工程で本発明の半導体装置用基板を得た。

【００４２】＜実施例４＞この実施例の半導体装置用基板は、幅３５μｍ、長さ７０μｍの長円形のバイアを９０°回転して組み合わせた十字型のバイアを有しており、実質的なバイアの短手方向の寸法に対する長手方向

の寸法の比が2倍となっているものである。そして、この半導体装置用基板は図5に示すような工程を経て製造されたものである。

【0043】まず、両面に18μmの銅箔を貼りつけた厚さ約0．6mmの銅張積層板（三菱ガス化学（株）製、商品名CCL-EL170）の表面を硫酸と過酸化水素を主成分とする液で洗浄し、水洗後すぐに約80℃の乾燥エアーを吹き付けて、汚れがなく表面状態が均一な状態にした。この後の工程で銅箔に配線パターンを形成するためのエッチングレジストとなる厚さ40μmのドライフィルム（日立化成工業（株）製、商品名フォテック）を両面に張り合わせた。所望の配線のネガパターンを形成したガラスマスクを重ね合わせ、紫外線を照射することにより被照射部のドライフィルムレジストが現像液で溶解しにくい状態にした後、炭酸ナトリウムを含有する現像液をスプレーで吹き付け、紫外線の当たらなかった部分のレジストを除去して、所望の配線パターンと同一のドライフィルムレジストのパターンを形成した。約50℃の塩化第二銅溶液を吹き付けて露出した銅箔部分を溶解除去し、次いで、約50℃の5%水酸化ナトリウム溶液をスプレーで吹き付けてドライフィルムレジストを剥離することにより最下層の配線パターンを形成した。

【0044】次に、黒化処理を行って配線パターン表面に酸化銅の皮膜を形成した。スクリーン印刷によって感光性樹脂インキ（太陽インキ製造（株）製、商品名PSR-4000）を約40μmの厚さになるように印刷し、表面がベトつかない程度にオーブンで乾燥させ室温に戻るまで放置した。マスクを使用せずに基板表面に紫外線を照射した。そして、130℃のオーブンに120分間入れて樹脂を硬化させた後、過マンガン酸カリウム溶液で樹脂表面を粗化してめっきの密着性の良い均一で微細な樹脂の凹凸を形成した。

【0045】次に、無電解めっき、電解めっきを順に行い、樹脂表面に約5μmの銅の皮膜を形成した。そして、最下層の配線パターン形成と同じ製造工程を経ることによって、銅の皮膜にバイアとなる形状が抜けた状態にした。このときのパターンは前述の如く幅35μm、長さ70μmの長円形のバイアを90°回転して組み合わせた十字型の形状を有するものである。さらに、短パルス炭酸ガスレーザー加工装置（三菱電機製505GT）で十字型の抜きパターン上におよそφ100μmのレーザービームを照射し、露出した樹脂を除去して銅の抜きパターンとほぼ同一の十字型の凹部を形成した。過マンガン酸カリウム溶液で樹脂の残滓を除去し、水洗・乾燥後、液状のエッチングレジスト（東京応化製、商品名PMER）をディップコートして基板全面にレジストの皮膜を形成した。このとき、レジストの粘度を100ポイズ以下の低粘度にし、縦型のディップコーターでゆっくりとレジストに浸漬することによって形成した凹部内に気泡が残らない状態でレジスト皮膜を形成することができる。また、引き上げ速度を10mm/min以下のゆっくりとした速度にすることで、凹部にはレジストが詰まった状態で、しかも表面には3μm以下の薄いレジスト皮膜が形成できる。10分間放置後、70℃のオーブンに30分間入れてレジストを乾燥させ、専用の現像液をスプレーで吹き付けて表面に薄く塗られたレジストを除去した。このとき、凹部のレジスト表面も同時に除去されるが、レジストの厚さに大きな差があるため、厚さの薄い表面のレジストだけが除去されて凹部のレジストのみが残る。その状態で約50℃の塩化第二銅溶液を吹き付けて表面の銅箔を溶解除去し、次いで、約50℃の5%水酸化ナトリウム溶液をスプレーで吹き付けてレジストを剥離した。

【0046】次に、無電解めっき、穴埋め電解めっきを順に行い、樹脂表面に約17μmの銅の皮膜を形成し、凹部はめっきで銅が充填されて表面が平滑な状態にした。

【0047】その後、2層目の配線パターンを形成し、さらに上記絶縁層・バイアの形成と同じ製造工程、次いで、最下層の配線パターン形成と同じ製造工程を再び経ることによって、2層目の絶縁層・バイアと3層目の配線パターを形成した。最後に表面の配線パターンを保護するための樹脂膜（ソルダーレジスト）を形成した。以上の工程で本発明の半導体装置用基板を得た。なお、本実施例ではバイアの形状を十字型としたが、本発明はこれにこだわるものではなく、配線の状況などによりL字型やT字型などの形状も採用できる。

【0048】<実施例5>この実施例の半導体装置用基板は、幅30μm、長さ50μmの長円形のバイアを有しており、バイアの短手方向の寸法に対する長手方向の寸法の比が約1．7倍となっているものである。また、この半導体装置用基板には、半導体素子をフリップチップ実装する端子と、実装用のはんだボールを接続するための端子をその裏面に設け、その対応する端子をつなぐ配線を設けたものである。そして、この半導体装置用基板は図5に示すような工程を経て製造されたものである。

【0049】まず、両面に18μmの銅箔を貼りつけた厚さ約0．6mmの銅張積層板（三菱ガス化学（株）製、商品名CCL-EL170）にφ300μmの穴をドリルであけ、無電解銅めっきと電解銅めっきを行って表裏の導通をとった。穴の中を樹脂で埋め込み表面が平滑になるように研磨した。銅箔に配線パターンを形成するためのエッチングレジストとなる厚さ40μmのドライフィルム（日立化成工業（株）製、商品名フォテック）を両面に貼り合わせた。所望の配線のネガパターンを形成したガラスマスクを重ね合わせ、紫外線を照射することにより被照射部のドライフィルムレジストが現像液で溶解しにくい状態にした後、炭酸ナトリウムを含有

する現像液をスプレーで吹き付け、紫外線の当たらなかった部分のレジストを除去して、所望の配線パターンと同一のドライフィルムレジストのパターンを形成した。約５０℃の塩化第二銅溶液を吹き付けて露出した銅箔部分を溶解除去し、次いで、約５０℃の５％水酸化ナトリウム溶液をスプレーで吹き付けてドライフィルムレジストを剥離することにより最下層の配線パターンを形成した。

【００５０】次に、黒化処理を行って配線パターン表面に酸化銅の皮膜を形成した。スクリーン印刷によって感光性樹脂インキ（太陽インキ製造（株）製、商品名ＰＳＲ－４０００）を約４０μｍの厚さになるように印刷し、表面がベトつかない程度にオーブンで乾燥させ室温に戻るまで放置した。マスクを使用せずに基板表面に紫外線を照射した。そして、１３０℃のオーブンに１２０分間入れて樹脂を硬化させた。ＵＶレーザー加工装置（住友重機械工業（株）製、ＬＡＶＩＡ－ＵＶ２０００）でφ３０μｍの凹部を形成し、引き続き１０μｍづつ位置をずらして２回レーザーを照射した。これにより、短径３０μｍ、長径５０μｍのバイアとなる樹脂の凹部を形成した。この時の凹部の形成方法は上記以外の方法、例えばレーザー加工装置のアパーチャーを円ではなく長円形にして一度に長円を加工しても良い。

【００５１】そして、１３０℃のオーブンに１２０分間入れて樹脂を硬化させた後、過マンガン酸カリウム溶液で樹脂表面を粗化してめっきの密着性の良い均一で微細な樹脂の凹凸を形成した。この時点でバイア底に樹脂の残渣のない良好な銅表面の安定した露出が確認できる。

【００５２】次に、無電解めっき、穴埋め電解めっきを順に行い、樹脂表面に１８μｍの銅の皮膜を形成した。このとき、レーザーで樹脂を除去して形成した凹部は銅めっきで完全に埋められ、フィルドバイアと呼ばれる表面が平滑の状態になった。

【００５３】その後、最下層の配線パターン形成と同じ製造工程を経ることによって、２層目の配点パターンを形成し、さらに上記絶縁層・バイアの形成と同じ製造工程、次いで、最下層の配線パターン形成と同じ製造工程を再び経ることによって、２層目の絶縁層・バイアと３層目の配線パターンを形成した。最後に表面の配線パターンを保護するための樹脂膜（ソルダーレジスト）を形成した。この時、１層目と２層目の配線パターンとをつなぐバイアの上に２層目と３層目の配線パターンをつなぐバイアを重ねて設けた。以上の工程で本発明の半導体装置用基板を得た。

【００５４】

【発明の効果】本発明は以上のような作用を持つから、バイアの寸法を小さくでき、高密度の配線パターンが、高い接続信頼性があり、また優れた信号の伝搬特性を有し、さらに安定して製造可能な、半導体装置用基板とすることができる。

【図面の簡単な説明】

【図１】本発明の一実施例に係るバイアの平面図である。

【図２】本発明の他の実施例に係るバイアの平面図である。

【図３】従来のバイアの平面図である。

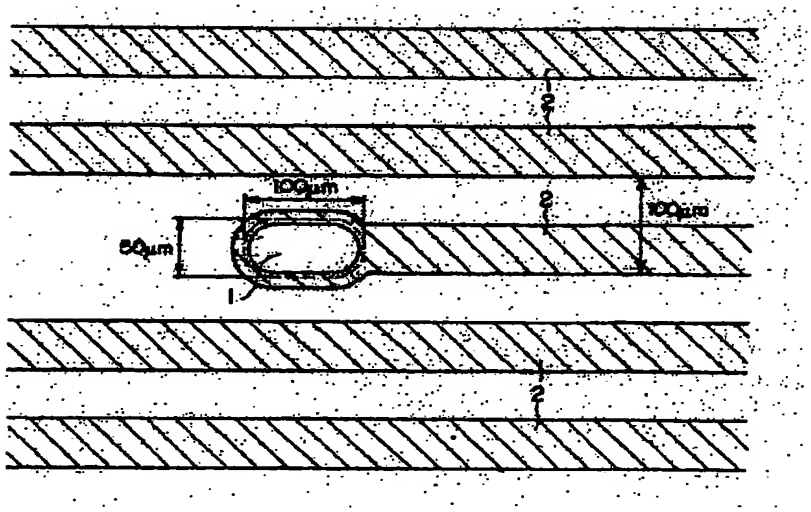
【図４】図２のバイアの断面図である。

【図５】従来のビルドアップ工法を用いたプリント配線板の製造工程を示す、断面説明図である。

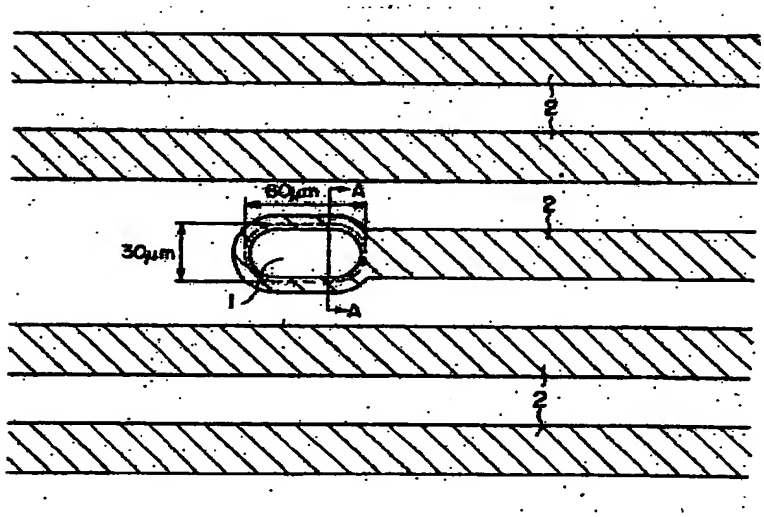
【符号の説明】

１・・・バイア
２・・・配線パターン
３・・・絶縁性樹脂
４・・・銅被膜
５・・・バイア
５１・・・絶縁基板
５２・・・配線パターン
５３・・・絶縁層
５４・・・バイア形成部
５５・・・バイア
５６・・・配線パターン
５７・・・絶縁層
５８・・・貫通孔
５９・・・バイア
６０・・・スルーホール
６１・・・配線パターン
６２・・・電源層のパターン
６３・・・ソルダーレジスト

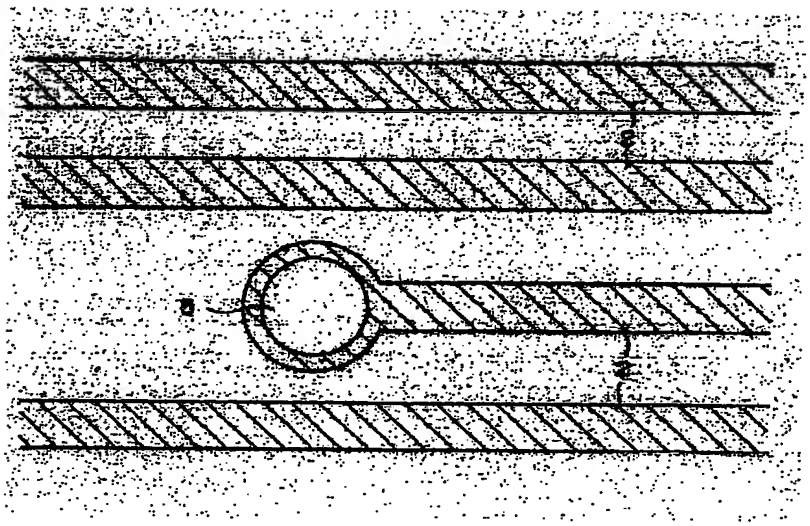
【図1】



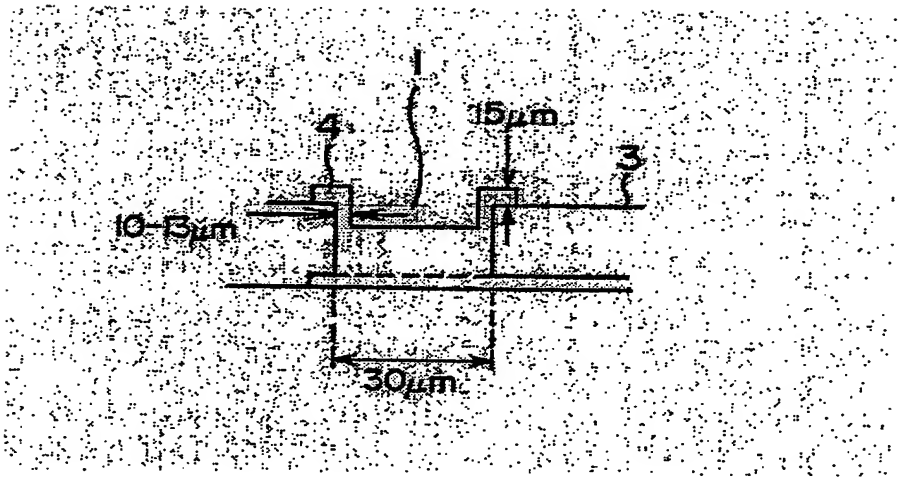
【図2】



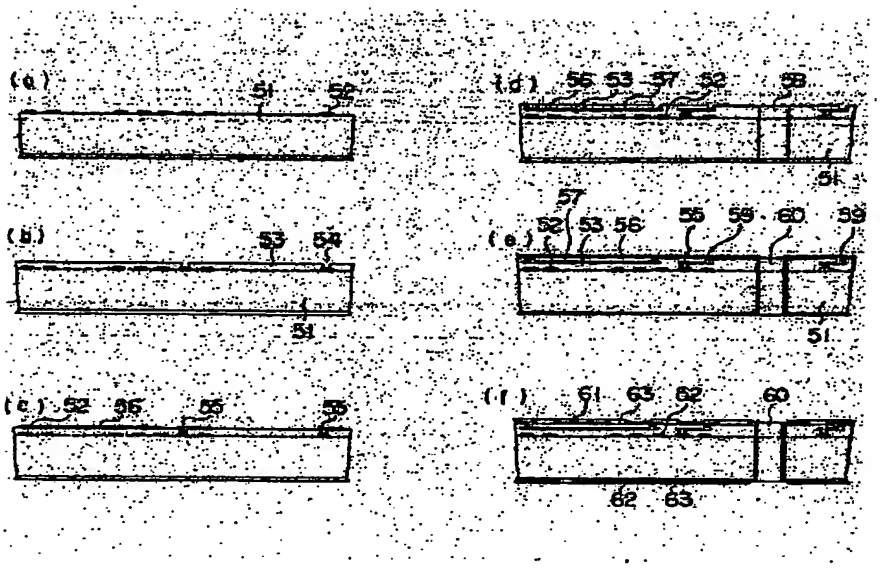
【図3】



【図4】



【図5】



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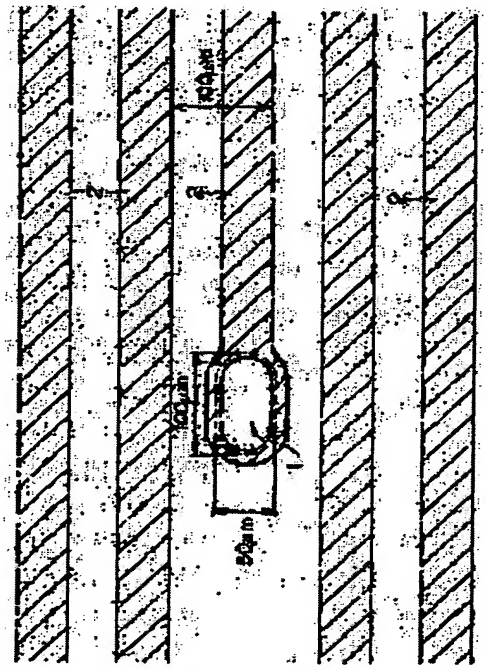
(54) SUBSTRATE FOR SEMICONDUCTOR DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To secure high connection reliability even with reduction in size of a via by forming the via nearly in a rectangular or elliptical shape.

SOLUTION: A via 1 is formed in such a shape that is elongated in the direction in which there is room to spare to prevent reduction in a connection area of the via 1 itself even with reduction in diameter. The shape of the via 1 is nearly rectangular such as rectangular, rectangular with rounded corners, and elliptical, but preferably is elliptical since a good etching characteristic and a good laser processibility can be achieved. For example, the via 1 is formed in a shape of an ellipse 50 μ m wide and 100 μm long, with the longitudinal dimension being twice as long as the transverse dimension. Due to this shape of the via 1, a connection strength and a conductor resistance value of the via 1 can be the same as those of a larger via, thereby obtaining the same wiring density as with a smaller via.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The substrate for semiconductor devices characterized by said Bahia being an abbreviation rectangle or an ellipse in the substrate for semiconductor devices with which it has the printed-circuit section to which the wiring layer arranged at insulating-layer a top and the bottom through Bahia which has two or more wiring layers and insulating layers which were accumulated by turns, and was established in the insulating layer is connected, and a semiconductor chip is carried on said printed-circuit section.
[Claim 2] The substrate for semiconductor devices according to claim 1 characterized by being the direction as the direction of the circuit pattern which it comes to extend from Bahia, or an adjoining circuit pattern where the sense of the longitudinal direction of Bahia of said abbreviation rectangle or an ellipse is the same.
[Claim 3] Claim 1 to which the dimension of a longitudinal direction [as opposed to the dimension of the direction of a short hand in said abbreviation rectangle or ellipse] is characterized by being 1.5 to 5 times, or the substrate for semiconductor devices according to claim 2.
[Claim 4] The substrate for semiconductor devices of claim 1 which the wiring layer of the Bahia top is formed by plating, and the path of the longitudinal direction of said Bahia is twice [more than] the thickness of the wiring layer of the Bahia top, and the path of the direction of a short hand is 2 double less or equal of the thickness of the wiring layer of the Bahia top, and is characterized by filling up Bahia with plating thru/or claim 3 given in any 1 term.
[Claim 5] The substrate for semiconductor devices characterized by said Bahia being the combination of the configuration of an abbreviation rectangle or an ellipse in the substrate for semiconductor devices with which it has two or more wiring layers and insulating layers which were accumulated by turns , and has the printed-circuit section to which the wiring layer arranged through Bahia established in the insulating layer at insulating-layer a top and the bottom is connected , and a semiconductor chip is carried on said printed-circuit section .
[Claim 6] The substrate for semiconductor devices of claim 1 characterized by filling up said Bahia with the conductive ingredient thru/or claim 3, and claim 5 given in any 1 term.
[Claim 7] The substrate for semiconductor devices according to claim 6 characterized by performing said restoration with plating.
[Claim 8] The substrate for semiconductor devices according to claim 7 with which said plating is characterized by being copper plating or nickel plating.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the good substrate for semiconductor devices of connection dependability and an electrical property, also when the substrate for semiconductor devices manufactured using the build up method is started, especially a wiring consistency becomes high and the magnitude of Bahia becomes small.
[0002]
[Description of the Prior Art] Electronic equipment is asked for a miniaturization and thin shape-ization so that it may be represented by the personal computer etc. in recent years. Therefore, in order to also ask an internal printed wired board for a miniaturization and thin shape-ization and to realize it, the width of face of a circuit pattern is thin, a gap is small, and the so-called high density wiring called multilayering of a wiring layer and minor-diameter-izing of Bahia which connects between wiring layers is called for. Moreover, if a thin insulating substrate and thin copper foil are used in order to form the thin insulating layer accompanying thin-shape-izing, and a thin wiring layer, ingredient cost will go up.
[0003] The printed wired board using the build up method as a printed wired board which solved these problems is known. This approach forms a multilayer printed wiring board by repeating the process of forming a circuit pattern on an insulating substrate, forming an insulating layer on it, forming a circuit pattern on it further, and forming an insulating layer further. This printed wired board is used also as a substrate for semiconductor devices which carries directly not only how as a parent substrate of carrying electronic parts, such as an IC package which carries a semiconductor chip on a leadframe and is obtained by carrying out a resin seal, and resistance components, capacitor components, to be used but an unit or two or more semiconductor chips, are gestalten, such as a ball grid array (BGA) and a grid-of-pins array (PGA), and is carried in a parent substrate as a semiconductor device. These semiconductor devices are also called the multi chip module (MCM) and the single chip module (SCM).
[0004] The example of the printed wired board using the build up method is explained according to drawing 5 . A circuit pattern 52 is first formed like drawing 5 (a) on the insulating substrate 51 which consists of rigid ingredients, such as a glass epoxy group plate. In this case, the method of forming a circuit pattern by etching using a double-sided copper-clad glass epoxy group plate is simple, and it is good. Then, the photosensitive epoxy resin of the part 54 which applies a photosensitive epoxy resin, forms an insulating layer 53 like drawing 5 (b), and forms Bahia is exposed and developed, and is removed. Thus, detailed Bahia can be obtained by forming Bahia at exposure and a development process. In addition, in view of the point that the method of applying resin in formation of an insulating layer can form an insulating layer simply by uniform thickness, it is desirable and screen printing, the curtain coat method, and the spin coat method are applied as the method of application. Polyimide resin, acrylic resin, etc. are used for others as an ingredient of an insulating layer. In addition, the approach of forming Bahia in insulating resin may be adopted using laser, such as not the approach of forming Bahia at exposure and a development process using a photopolymer as mentioned above but carbon dioxide laser, and an YAG laser, an excimer laser. In this case, insulating resin does not need to be a photosensitive ingredient. And like drawing 5 (c), copper foil is formed with nonelectrolytic plating and electrolysis plating at an insulating-layer 53 top, Bahia 55 is formed, and a circuit pattern 56 is formed by etching the formed copper foil. Under the present circumstances, nonelectrolytic plating is a thing gives conductivity on an insulating layer and make it the electrolysis plating of attained and to perform for accumulating. in addition -- circuit pattern formation -- both a subtractive process and an additive process -- although -- it is applicable. Next, as shown in drawing 5 (d), an insulating layer 57 is formed in the whole surface, and exposure development of the Bahia section is carried out. The approach of formation is the same as the approach used at the process of drawing 5 (b), and is good. Furthermore, the through tube 58 for through holes is formed using a drill. And it galvanizes at the same process as drawing 5 (c), and Bahia 59 and a through hole 60 are formed (drawing 5 (e)). In this case, a through hole 60 has the desirable one where an aperture is smaller if possible so that it may not become the failure of high density formation of a circuit pattern. Then, a circuit pattern 61 is formed by etching. In this case, the copper foil of a field opposite to the side in which the surface wiring layer was formed is also etched into coincidence, and let it be the pattern 62 of a voltage plane. And the solder resist 63 which protects a circuit pattern 61 and the pattern 62 of a voltage plane is formed, and a printed wired board is completed (drawing 5 R> 5 (f)). Bahia known from the former which was explained above had the circular flat-surface configuration, and, also as for Bahia formed by the so-called FOTORISO method which used the photopolymer, and Bahia formed with the laser process, it was [the flat-surface configuration] common that it was circular.
[0005] By the way, by technical progress in recent years, it is tended increasingly to reduce the dimension of a circuit pattern, and what also has smaller Bahia is called for. However, the pitch of the Bahia section had to be enlarged as compared with the dimension of a circuit pattern. In order to raise the connection dependability of Bahia, the hole of a certain amount of magnitude was opened, it was quite larger than the magnitude of a hole, and the magnitude of a land needed to be set up. However, if the dimension of Bahia is simply made small, the cross-sectional area of Bahia will become small by the square of the dimension (radius) of Bahia. And in the build up method, connection between the wiring layers of Bahia and the bottom is made by the base of Bahia, and the top face of a bottom wiring layer. Therefore, it is still more difficult for it to be stabilized and to secure the flow of the vertical layer in the Bahia section. That is, telescopic motion occurs in the thickness direction of an insulating layer by generation of heat at the time of reliability trials and component mounting, such as a spalling test, and use. If the dimension of Bahia is made small, it is becoming impossible to maintain sufficient connection resilience, also when satisfactory if the connection resilience of the Bahia vertical layer at this time has the large dimension of Bahia like before since it is proportional to the cross-sectional area of Bahia mostly. Furthermore, increase of the resistance of Bahia affects the propagation property of a signal, and effect becomes remarkable, so that the frequency is high. Moreover, if the dimension of Bahia is small, the trouble on manufacture -- become or being hard of resist pattern formation becomes that plating deposits in Bahia difficultly -- will also come out.
[0006]

[Problem(s) to be Solved by the Invention] The place which this invention was made paying attention to such a trouble, and is made into the technical problem It is being able to secure high connection dependability and offering the structure of Bahia which can be attained to coincidence for maintenance of the propagation property of a signal, and stabilization of a manufacture process, also when the dimension of Bahia is made small. The circuit pattern of high density with therefore, high dependability Moreover, it is in having the outstanding propagation property of a signal, being stabilized further, and offering the substrate for semiconductor devices which can be manufactured.

[0007]

[Means for Solving the Problem] This invention is what solves this technical problem. Invention of claim 1 It has the printed-circuit section to which the wiring layer arranged at insulating-layer a top and the bottom through Bahia which has two or more wiring layers and insulating layers which were accumulated by turns, and was established in the insulating layer is connected. And in the substrate for semiconductor devices with which a semiconductor chip is carried on said printed-circuit section, it considers as the substrate for semiconductor devices characterized by said Bahia being an abbreviation rectangle or an ellipse.

[0008] Invention of claim 2 of this invention is taken as the substrate for semiconductor devices according to claim 1 characterized by being the direction as the direction of the circuit pattern which it comes to extend from Bahia, or an adjoining circuit pattern where the sense of the longitudinal direction of Bahia of said abbreviation rectangle or an ellipse is the same.

[0009] Invention of claim 3 of this invention is taken as claim 1 to which the dimension of a longitudinal direction [as opposed to the dimension of the direction of a short hand in said abbreviation rectangle or ellipse] is characterized by being 1.5 to 5 times, or the substrate for semiconductor devices according to claim 2.

[0010] As for invention of claim 4 of this invention, the wiring layer of the Bahia top is formed by plating. The path of the longitudinal direction of said Bahia is twice [more than] the thickness of the wiring layer of the Bahia top. And it considers as the substrate for semiconductor devices of claim 1 which the path of the direction of a short hand is 2 double less or equal of the thickness of the wiring layer of the Bahia top, and is characterized by filling up Bahia with plating thru/or claim 3 given in any 1 term.

[0011] Invention of claim 5 of this invention is taken as the substrate for semiconductor devices characterized by for said Bahia to be the combination of the configuration of an abbreviation rectangle or an ellipse in the substrate for semiconductor devices with which it has two or more wiring layers and insulating layers accumulated by turns , and it has the printed circuit section to which the wiring layer arranged through Bahia established in the insulating layer at insulating layer a top and the bottom is connected , and a semiconductor chip is carried on said printed circuit section .

[0012] Invention of claim 6 of this invention is the substrate for semiconductor devices of claim 1 characterized by filling up said Bahia with the conductive ingredient thru/or claim 3, and claim 5 given in any 1 term.

[0013] Invention of claim 7 of this invention is taken as the substrate for semiconductor devices according to claim 6 with which said restoration is characterized by being carried out with plating.

[0014] Said plating uses invention of claim 8 of this invention as the substrate for semiconductor devices according to claim 7 characterized by being copper plating or nickel plating.

[0015]

[Embodiment of the Invention] The substrate for semiconductor devices of this invention is explained below at a detail based on an operation gestalt. Namely, it tends to form Bahia of the lengthened configuration in the direction which has allowances in a tooth space in order not to make connection area of Bahia itself small, even if invention concerning claim 1 makes the path of Bahia small. this -- the connection resilience of the Bahia section, and a conductor -- a wiring consistency equivalent to the case where Bahia is made small can be obtained, maintaining resistance at bigger Bahia and a bigger EQC. Moreover, it can turn one on the process of the plating and etching of Bahia, and stability equivalent to big Bahia can be acquired. Although abbreviation rectangles, such as a rectangle, a rectangle which rounded off the corner of a corner, and an ellipse, can be used as a configuration of Bahia, since plating liquid cannot enter into the corner of a rectangular corner easily, the configuration of an ellipse can be used from a point with good etching property and laser-processing nature desirable still more suitably [the rectangle which rounded off the corner of a corner] in the case of plating.

[0016] And in invention according to claim 2, when connecting with a lower wiring layer from the upper wiring layer in Bahia, and the longitudinal direction of Bahia is the same as the direction of wiring, in many cases, it is generous, and even if the tooth space of this direction lengthens Bahia, it does not reduce a wiring consistency in comparison. Moreover, since Bahia is adjoined and two or more wiring is running in parallel when a wiring consistency is high, it is effective in the wiring consistency fall prevention by Bahia to make in agreement the direction of wiring and the longitudinal direction of Bahia at least in this wiring layer. Although drawing 1 is one example of this invention, as it is shown in drawing, Bahia with a 50 micrometer die length [like this invention / of ****] of 100 micrometers can be arranged, without influencing the wiring consistency of the pattern whose wiring pitch is 100 micrometers, but if it is going to put in conventional phi100-micrometer Bahia here as it is, as shown in drawing 3 , it becomes impossible to form neighboring wiring of two, and a wiring consistency will fall remarkably. Moreover, even if it extends some wiring pitches and optimizes them, wiring of about 1 duty can be formed.

[0017] Next, invention according to claim 3 shows the magnitude which can be used as Bahia. That is, the proportion of the longitudinal direction to the dimension of the direction of a short hand can use a 1.5 to 5 times as many thing as this. Only connection dependability equivalent to a circular thing can be expected to be 1.5 or less times to the dimension of the direction of a short hand. Moreover, area becomes it large that they are 5 or more times too much, and a wiring consistency falls. Generally, the layer of an insulating-layer top and the bottom will check the flow of wiring of the direction of a short hand remarkably, when the wiring direction which becomes main becomes 5 or more times since it wires so that it may intersect perpendicularly mutually in order to raise wiring effectiveness.

[0018] Next, by invention according to claim 4, the thickness of the wiring layer of the Bahia top shows the magnitude which can be used as Bahia. That is, the wiring layer of the Bahia top is formed by plating, the dimension of the longitudinal direction is twice [more than] the thickness of the wiring layer of the Bahia top, and the dimension of the direction of a short hand is 2 double less or equal of the thickness of the wiring layer of the Bahia top. And Bahia is further filled up with plating. Since the dimension of a longitudinal direction has set up the more than twice of the thickness of the wiring layer of the Bahia top, it is connectable with high connection dependability, since the dimension of the direction of a short hand is 2 double less or equal of the thickness of the wiring layer of the Bahia top, wiring of a high consistency can be enabled, and the interior of Baia can be further filled up with plating certainly.

[0019] Next, in invention of claim 5, when connecting with a lower wiring layer from the upper wiring layer in Bahia, and the upper wiring layer and a lower wiring layer are not parallel, the fall of a wiring consistency can be prevented by making the configuration of Bahia into the form which combined Bahia of an abbreviation rectangle parallel to each wiring layer, or an ellipse.

[0020] Next, it is easy by embedding Bahia by the conductive matter in invention of claims 6-8 for a front face to become smooth and

to form a resist fine pattern formation and on it. moreover, the connection resilience of Bahia -- rising -- a conductor -- resistance decreases and connection dependability increases. Furthermore, the degree of freedom of a design improves by forming Bahia in piles on Bahia.
[0021] Since this inventions are the above contents, also when the dimension of Bahia is made small, they can secure high connection dependability and have the operation which makes maintenance of the propagation property of a signal, and stabilization of a manufacture process the structure of Bahia which can be attained to coincidence.
[0022]
[Example] Next, the concrete example of this invention is explained below with reference to a drawing at a detail.
[0023] <Example 1> The substrate for semiconductor devices of this example has Bahia of width of face of 50 micrometers, and a die-length 100micrometer ellipse, and the ratio of the dimension of the longitudinal direction to the dimension of the short hand approach of Bahia has become twice. And this substrate for semiconductor devices is manufactured through a process as shown in drawing 5 .
[0024] First, the front face of the copper clad laminate (trade name CCL-EL170 by Mitsubishi Gas Chemical Co., Inc.) with a thickness of 1.2mm which stuck copper foil with a thickness of 18 micrometers on the front face of a GARASU epoxy resin is washed, and the dry film (trade name FOTEKKU by Hitachi Chemical Co., Ltd.) used as the etching resist for forming a circuit pattern in copper foil at a next process was stuck. The mask film in which the negative pattern of desired wiring was formed was piled up, negatives were exposed and developed, and the etching resist pattern was formed on copper foil. The copper foil part which sprayed the ferric-chloride solution by the spray and exposed it was dissolved, and it removed. The sodium-hydroxide solution was sprayed by the spray and etching resist was exfoliated completely. The circuit pattern used as the lowest layer was formed on the GARASU epoxy resin substrate through the above process.
[0025] in order [next,] to raise the adhesion of a circuit pattern and the insulating resin formed next -- melanism -- processing called processing was performed and the coat of copper oxide was formed in the circuit pattern front face. With screen printing, photopolymer ink (Asahi National-chemical-laborator trade name DPR- 105) was printed so that it might become about 30 micrometers in thickness, and it was dried. After exposing in piles the mask film which has a sunspot used as Bahia of width of face of 50 micrometers, and a die-length 100micrometer ellipse, the parts of width of face of 50 micrometers on which 1, 1, and 1-trichloroethane was sprayed by the spray and which light did not hit, and a die-length 100micrometer ellipse were removed.
[0026] In addition, when, and it was about phi80micrometer, there are no remnants and negatives could be finely developed [whose Bahia is] like before, but when it became about phi50micrometer, since a developer was not able to go into the interior easily, negatives were hard to be developed to the bottom, and all Bahia had become defective continuity. That is, the resolution limit of this condition of this insulating resin is set to 50-80 micrometers. Then, by making Bahia into width of face of 50 micrometers, and an ellipse with a die length of 100 micrometers like this invention, if the direction of a short hand of a longitudinal direction of Bahia is larger than it enough to below a resolution limit value, development will become possible, without remnants remaining in the bottom of Bahia. According to the above process, the hollow of the resin used as Bahia of an ellipse was formed.
[0027] Furthermore, after baking for about 60 minutes at 130 degrees and stiffening resin, it processed with the permanganic acid solution, the resin front face was roughened, non-electrolytic copper plating and electrolytic copper plating were performed in order, and the coat of copper with a thickness of about 20 micrometers was formed in the whole insulating resin surface surface and Bahia. Then, the circuit pattern of a two-layer eye was formed by passing through the same production process as circuit pattern formation of the lowest layer. The substrate for semiconductor devices of this invention was obtained at the above process.
[0028] <Example 2> The substrate for semiconductor devices concerning the gestalt of this operation has Bahia of width of face of 30 micrometers, and a die-length 60micrometer ellipse, and the ratio of the dimension of the longitudinal direction to the dimension of the short hand approach of Bahia has become twice. And this substrate for semiconductor devices is manufactured through a process as shown in drawing 5 .
[0029] First, the phi300micrometer hole was made and plated to the copper clad laminate (trade name CCL-EL170 by Mitsubishi Gas Chemical Co., Inc.) with a thickness of 0.4mm which stuck copper foil with a thickness of 18 micrometers on the front face of a GARASU epoxy resin, and it was made to flow through a front flesh side. A front face is washed and the dry film (trade name FOTEKKU by Hitachi Chemical Co., Ltd.) used as the etching resist for forming a circuit pattern in copper foil at a next process was stuck. The mask film in which the negative pattern of desired wiring was formed was piled up, negatives were exposed and developed, and the etching resist pattern was formed on copper foil. The copper foil part which sprayed the ferric-chloride solution by the spray and exposed it was dissolved, and it removed. The sodium-hydroxide solution was sprayed by the spray and etching resist was exfoliated completely. The circuit pattern used as the lowest layer was formed on the GARASU epoxy resin substrate through the above process.
[0030] in order [next,] to raise the adhesion of a circuit pattern and the insulating resin formed next -- melanism -- processing called processing was performed and the coat of copper oxide was formed in the circuit pattern front face. By the curtain coat method, photopolymer ink (Ciba-Geigy Japan trade name pro BIMA 52) was printed so that it might become about 50 micrometers in thickness, and it was dried. In order to form comparatively big patterns other than the part used as Bahia, after exposing in piles the mask film which has the pattern which shades this part, the resin of a part upon which the pro BIMA developer was sprayed by the spray, and light did not shine was removed. After having raised temperature to 130 degrees C further, having baked for 60 minutes, after baking at 100 degrees C for 30 minutes, and stiffening resin, buffing of the front face was carried out and surface irregularity, the canopy top generated in development, and the hard coat generated by exposure were removed.
[0031] Next, the hollow with a width of face [of 30 micrometers] and a die length of 60 micrometers used as Bahia was formed with the ultraviolet-rays laser beam machine (trade name model 5100 laser-beam-machining equipment made from ESI). At this time, beam diameter phi30micrometer laser was processed with the swing in the range with a width of face of 60 micrometers, and the target configuration was acquired. Thus, having carried out processing of those other than Bahia independently Since the ultraviolet-rays laser beam machine fits processing of an about [phi30-50micrometer] small hole to the ability to form only Bahia which is about phi100-125micrometer since this photopolymer ink is inferior in definition, what has both patterns of the magnitude beyond diameter Bahia of the minimum, about 150-micrometer Bahia, or it like this example -- FOTORISO -- the combination of law and a laser process is useful.
[0032] Furthermore, it processed with the permanganic acid solution, the resin front face was roughened, non-electrolytic copper plating and electrolytic copper plating were performed in order, and the coat of 10-13-micrometer copper was formed in 15 micrometers in thickness, and Bahia all over the insulating resin front face as shown in drawing 4 .
[0033] In addition, since the plating coat of the upper part of Bahia would become thick and an entry part would be closed while plating attaches only 2-7 micrometers in Bahia if conventional phi30-micrometer Bahia is galvanized on the same conditions, the dependability of Bahia could not but be what was remarkably inferior. Thus, by making Bahia into an ellipse from a perfect circle, especially the connection dependability of about [phi30micrometer] diameter Bahia of the minimum has improved sharply. Then, the

circuit pattern of the two-layer eye which has the land of the shape of a matrix for forming a solder ball in the opposite side for the pattern which has a pad for flip chip loading in one side was formed by passing through the same production process as circuit pattern formation of the lowest layer. The substrate for semiconductor devices of this invention was obtained at the above process.

[0034] <Example 3> The substrate for semiconductor devices of this example has Bahia of width of face of 50 micrometers, and a die-length 80micrometer ellipse, and the ratio of the dimension of the longitudinal direction to the dimension of the direction of a short hand of Bahia has become 1.6 times. And this substrate for semiconductor devices is manufactured through a process as shown in drawing 5 .

[0035] First, the liquid which uses a sulfuric acid and a hydrogen peroxide as a principal component washes the front face of the copper clad laminate (the Mitsubishi Gas Chemical Co., Inc. make, trade name CCL-EL170) with a thickness of about 0.6mm which stuck 18-micrometer copper foil on both sides, about 80-degree C desiccation Ayr is immediately sprayed after rinsing, there is no dirt, and the surface state changed into the uniform condition. The dry film (trade name FOTEKKU by Hitachi Chemical Co., Ltd.) with a thickness of 40 micrometers it is thin to the etching resist for forming a circuit pattern in copper foil at a next process was stuck on both sides. After the dry film resist of the irradiated section changed the glass mask in which the negative pattern of desired wiring was formed into the condition of being hard to dissolve with a developer, by irradiating superposition and ultraviolet rays, the developer containing a sodium carbonate was sprayed by the spray, the resist of a part which ultraviolet rays did not hit was removed, and the desired circuit pattern and the pattern of the same dry film resist were formed. Dissolution removal of the copper foil part which sprayed about 50-degree C cupric-chloride solution, and was exposed was carried out, and the circuit pattern of the lowest layer was formed by spraying a sodium-hydroxide solution by the spray 5 about 50-degree C%, and subsequently, exfoliating a dry film resist.

[0036] next, melanism -- it processed and the coat of copper oxide was formed in the circuit pattern front face. By screen-stencil, photopolymer ink (the Taiyo Ink Mfg. make, trade name PSR-4000) was left until it printed so that it might become the thickness of about 40 micrometers, and the front face dried in oven the Beto ** or extent which is not and it returned to the room temperature. Ultraviolet rays were irradiated so that alignment of the mask which has the nontransparent pattern of die length of 80 micrometers and a width-of-face 50micrometer ellipse might be carried out and superposition and light exposure might become 500 - 800 mJ/cm2. In addition, the mask used at this time used that by which the protection-from-light pattern of chromium was formed on quartz glass. It is difficult from the mask engine performance to use the glass mask and film mask of a cheap emulsion, to be stabilized and to resolve the pattern of die length of 80 micrometers, and a width-of-face 50micrometer ellipse. And the crevice of the resin which develops negatives with a sodium-carbonate solution and serves as Bahia was formed.

[0037] And after putting into 130-degree C oven for 120 minutes and stiffening resin, the resin front face was roughened with the potassium permanganate solution, and the irregularity of the good uniform and detailed resin of the adhesion of plating was formed. The exposure by which the good copper front face which does not have the remnants of resin in the Bahia bottom was stabilized at this time has been checked. Although the crevice which is stabilized even phi80micrometer and serves as Bahia as well as phi50micrometer was not able to be formed when it was going to form usual circular Bahia like before, the high quality mask with which the protection-from-light pattern of chromium was formed on quartz glass was used, and it became possible by making Bahia into an ellipse. Thus, enlarging to the diameter of Bahia which can resolve [of circular Bahia] the dimension of the direction of a major axis of Bahia, even if the direction of a minor axis of Bahia is the dimension which is resolution threshold value extent when resolving Bahia near the resolution threshold value of a photopolymer, and the edge of a pattern were clear, and definition and its stability improved sharply by using the high quality mask which has the protection-from-light section and the high transparency section of permeability excellent in protection-from-light nature.

[0038] Next, nonelectrolytic plating and electrolysis plating were performed in order, and the coat of about 23-micrometer copper was formed in the resin front face. At this time, the crevice which removed the photopolymer was completely fill uped with copper plating, and changed into the condition that the front face called fill DOBAIA is smooth. When it was going to form circular Bahia like before, in phi80micrometer Bahia, plating could not finish being buried, a crevice was not able to remain in a front face, and perfect fill DOBAIA was not able to be obtained. That is, when it is going to fill up Bahia with plating, it is based on the depth of plating conditions or a crevice, the surface plating thickness set point, etc., but when it becomes a diameter beyond two to 3 times or it of surface plating thickness, it is difficult [it] to fill Bahia completely. For example, if 30-40 micrometers and the diameter of Bahia are set more than phi80micrometer and surface plating thickness is set to 10-20 micrometers for the depth of a crevice, even if it is going to embed Bahia and galvanizes, a crevice will remain. On the contrary, in order to have embedded Bahia on this condition, the diameter of Bahia had to be made about phi60micrometer or into less than [it], and surface plating thickness had to be made thick to about 40 micrometers or more (when insurance is seen, it is 60 micrometers or more). When it became so, there was a problem that it became difficult for it to be stabilized and to form the crevice not more than phi80micrometer phi50micrometer etc., or formation of a detailed circuit with a conductor width of about 50 micrometers became difficult.

[0039] On the other hand, in this invention, since the volume of a crevice and the cross section of the direction of a minor axis which must be embedded by forming Bahia of the ellipse of the major axis of 80 micrometers and 50 micrometers of minor axes decrease and the crevice itself becomes a configuration advantageous to embedding instead of forming phi80micrometer circular Bahia, it comes to bury and put, without making surface plating thickness increase.

[0040] In addition, when a crevice is circular, it is generally decided by the ratio of the plating volume of the crevice when attaching uniform plating to a front face and a crevice, and the volume of the crevice itself whether to bury by plating and put. Although it will be buried [count top usual plating or] if this ratio is 1:1, at least about 1:1.five to 1:2 ratio can fill a crevice in stopgap plating. Since the Bahia cross section of a minor axis embeds and it becomes dominance from the volume of a crevice as conditions when a crevice is made into an ellipse in addition to it, it can embed on condition that the circle of the almost same path as a minor axis. Therefore, since stopgap plating and the combination of ellipse Bahia can do embedding of Bahia where the Bahia cross-sectional area is fully secured, its merit is large.

[0041] Then, the insulating layer and Bahia of a two-layer eye, and the circuit pattern of the 3rd layer were formed by forming the circuit pattern of a two-layer eye and passing through the still more nearly same production process as formation of above-mentioned insulating layer and Bahia, and the production process same subsequently as circuit pattern formation of the lowest layer again by passing through the same production process as circuit pattern formation of the lowest layer. The resin film (solder resist) for finally protecting a surface circuit pattern was formed. The substrate for semiconductor devices of this invention was obtained at the above process.

[0042] <Example 4> The substrate for semiconductor devices of this example has Bahia of the cross-joint mold which rotated 90 degrees and combined Bahia of width of face of 35 micrometers, and a die-length 70micrometer ellipse, and the ratio of the dimension of the longitudinal direction to the dimension of the direction of a short hand of substantial Bahia has become twice. And this substrate for semiconductor devices is manufactured through a process as shown in drawing 5 .

[0043] First, the liquid which uses a sulfuric acid and a hydrogen peroxide as a principal component washes the front face of the copper clad laminate (the Mitsubishi Gas Chemical Co., Inc. make, trade name CCL-EL170) with a thickness of about 0.6mm which stuck 18-micrometer copper foil on both sides, about 80-degree C desiccation Ayr is immediately sprayed after rinsing, there is no dirt, and the surface state changed into the uniform condition. The dry film (the Hitachi Chemical Co., Ltd. make, trade name FOTEKKU) with a thickness of 40 micrometers it is thin to the etching resist for forming a circuit pattern in copper foil at a next process was made to rival to both sides. After the dry film resist of the irradiated section changed the glass mask in which the negative pattern of desired wiring was formed into the condition of being hard to dissolve with a developer, by irradiating superposition and ultraviolet rays, the developer containing a sodium carbonate was sprayed by the spray, the resist of a part which ultraviolet rays did not hit was removed, and the desired circuit pattern and the pattern of the same dry film resist were formed. Dissolution removal of the copper foil part which sprayed about 50-degree C cupric-chloride solution, and was exposed was carried out, and the circuit pattern of the lowest layer was formed by spraying a sodium-hydroxide solution by the spray 5 about 50-degree C%, and subsequently, exfoliating a dry film resist.
[0044] next, melanism -- it processed and the coat of copper oxide was formed in the circuit pattern front face. By screen-stencil, photopolymer ink (the Taiyo Ink Mfg. make, trade name PSR-4000) was left until it printed so that it might become the thickness of about 40 micrometers, and the front face dried in oven the Beto ** or extent which is not and it returned to the room temperature. Ultraviolet rays were irradiated on the substrate front face, without using a mask. And after putting into 130-degree C oven for 120 minutes and stiffening resin, the resin front face was roughened with the potassium permanganate solution, and the irregularity of the good uniform and detailed resin of the adhesion of plating was formed.
[0045] Next, nonelectrolytic plating and electrolysis plating were performed in order, and the coat of about 5-micrometer copper was formed in the resin front face. And it changed into the condition that the configuration used as Bahia fell out to the copper coat, by passing through the same production process as circuit pattern formation of the lowest layer. The pattern at this time has the configuration of the cross-joint mold which rotated 90 degrees and combined Bahia of width of face of 35 micrometers, and a die-length 70micrometer ellipse like the above-mentioned. Furthermore, the cross-joint mold extracted with short pulse carbon-dioxide-laser processing equipment (Mitsubishi Electric 505GTs), the resin which irradiated the phi100micrometer laser beam about and was exposed on the pattern was removed, copper extracted, and the crevice of the almost same cross-joint mold as a pattern was formed. The potassium permanganate solution removed the remnants of resin, after rinsing / desiccation, the DIP coat of the liquefied etching resist (Tokyo adaptation make, a trade name (PMER)) was carried out, and the coat of a resist was formed all over the substrate. At this time, viscosity of a resist can be made into hypoviscosity 100poise or less, and a resist coat can be formed in the condition that air bubbles do not remain, in the crevice formed by being slowly immersed in a resist by the dip coater of a vertical mold. By making a raising rate into the rate of 10 or less mm/min carried out slowly, it is in the condition with which the resist was got blocked in the crevice, and, moreover, a thin resist coat 3 micrometers or less can be formed in a front face. The resist which put into 70-degree C oven for 30 minutes, was made to dry a resist, sprayed the developer of dedication by the spray, and was thinly applied to the front face was removed after neglect for 10 minutes. Although the resist front face of a crevice is also removed by coincidence at this time, since a big difference is in the thickness of a resist, only the resist of the front face where thickness is thin is removed, and only the resist of a crevice remains. About 50-degree C cupric-chloride solution was sprayed in the condition, dissolution removal of the surface copper foil was carried out, subsequently, the sodium-hydroxide solution was sprayed by the spray 5 about 50-degree C%, and the resist was exfoliated.
[0046] Next, nonelectrolytic plating and stopgap electrolysis plating were performed in order, the coat of about 17-micrometer copper was formed in the resin front face, copper was filled up with plating and the front face changed the crevice into the smooth condition.
[0047] Then, the insulating layer and Bahia of a two-layer eye, and the wiring putter of the 3rd layer were formed by forming the circuit pattern of a two-layer eye and passing through the still more nearly same production process as formation of above-mentioned insulating layer and Bahia, and the production process same subsequently as circuit pattern formation of the lowest layer again. The resin film (solder resist) for finally protecting a surface circuit pattern was formed. The substrate for semiconductor devices of this invention was obtained at the above process. In addition, although the configuration of Bahia was used as the cross-joint mold in this example, this invention does not adhere to this and can also adopt the configuration of a L character mold, a T character mold, etc. according to the situation of wiring etc.
[0048] <Example 5> The substrate for semiconductor devices of this example has Bahia of width of face of 30 micrometers, and a die-length 50micrometer ellipse, and the ratio of the dimension of the longitudinal direction to the dimension of the direction of a short hand of Bahia has become about 1.7 times. Moreover, the terminal which carries out flip chip mounting of the semiconductor device, and the terminal for connecting the solder ball for mounting are prepared in that rear face, and wiring which connects that corresponding terminal is prepared in this substrate for semiconductor devices. And this substrate for semiconductor devices is manufactured through a process as shown in drawing 5 .
[0049] First, the phi300micrometer hole was made in the copper clad laminate (the Mitsubishi Gas Chemical Co., Inc. make, trade name CCL-EL170) with a thickness of about 0.6mm which stuck 18-micrometer copper foil on both sides with the drill, non-electrolytic copper plating and electrolytic copper plating were performed, and the flow of a front flesh side was taken. It ground so that the inside of a hole might be embedded by resin and a front face might become smooth. The dry film (the Hitachi Chemical Co., Ltd. make, trade name FOTEKKU) with a thickness of 40 micrometers it is thin to the etching resist for forming a circuit pattern in copper foil was stuck on both sides. After the dry film resist of the irradiated section changed the glass mask in which the negative pattern of desired wiring was formed into the condition of being hard to dissolve with a developer, by irradiating superposition and ultraviolet rays, the developer containing a sodium carbonate was sprayed by the spray, the resist of a part which ultraviolet rays did not hit was removed, and the desired circuit pattern and the pattern of the same dry film resist were formed. Dissolution removal of the copper foil part which sprayed about 50-degree C cupric-chloride solution, and was exposed was carried out, and the circuit pattern of the lowest layer was formed by spraying a sodium-hydroxide solution by the spray 5 about 50-degree C%, and subsequently, exfoliating a dry film resist.
[0050] next, melanism -- it processed and the coat of copper oxide was formed in the circuit pattern front face. By screen-stencil, photopolymer ink (the Taiyo Ink Mfg. make, trade name PSR-4000) was left until it printed so that it might become the thickness of about 40 micrometers, and the front face dried in oven the Beto ** or extent which is not and it returned to the room temperature. Ultraviolet rays were irradiated on the substrate front face, without using a mask. And it put into 130-degree C oven for 120 minutes, and resin was stiffened. The phi30micrometer crevice was formed with UV laser-processing equipment (the Sumitomo Heavy Industries, Ltd. make, LAVIA-UV2000), it shifted 10 micrometers of locations at a time succeedingly, and laser was irradiated twice. This formed the crevice of the resin with 30 micrometers [of minor axes], and a major axis of 50 micrometers used as Bahia. The formation approach of the crevice at this time may make approaches other than the above, for example, the aperture of laser-beam-machining equipment, the ellipse instead of a circle, and may process an ellipse at once.

[0051] And after putting into 130-degree C oven for 120 minutes and stiffening resin, the resin front face was roughened with the potassium permanganate solution, and the irregularity of the good uniform and detailed resin of the adhesion of plating was formed. The exposure by which the good copper front face which does not have the remnants of resin in the Bahia bottom was stabilized at this time can be checked.
[0052] Next, nonelectrolytic plating and stopgap electrolysis plating were performed in order, and the coat of 18-micrometer copper was formed in the resin front face. At this time, the crevice which removed and formed resin by laser was completely fill uped with copper plating, and changed into the condition that the front face called fill DOBAIA is smooth.
[0053] Then, the insulating layer and Bahia of a two-layer eye, and the circuit pattern of the 3rd layer were formed by forming the allocation-of-marks pattern of a two-layer eye, and passing through the still more nearly same production process as formation of above-mentioned insulating layer and Bahia, and the production process same subsequently as circuit pattern formation of the lowest layer again by passing through the same production process as circuit pattern formation of the lowest layer. The resin film (solder resist) for finally protecting a surface circuit pattern was formed. At this time, Bahia which connects a two-layer eye and the circuit pattern of the 3rd layer was prepared in piles on Bahia which connects the 1st layer and the circuit pattern of a two-layer eye. The substrate for semiconductor devices of this invention was obtained at the above process.
[0054]
[Effect of the Invention] Since it has the above operations, this invention can make the dimension of Bahia small, and there is high connection dependability, and the circuit pattern of high density has the outstanding propagation property of a signal, is stabilized further, and can use it as the substrate for semiconductor devices which can be manufactured.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of Bahia concerning one example of this invention.
[Drawing 2] It is the top view of Bahia concerning other examples of this invention.
[Drawing 3] It is the top view of conventional Bahia.
[Drawing 4] It is the sectional view of Bahia of drawing 2 .
[Drawing 5] It is the cross-section explanatory view showing the production process of the printed wired board using the conventional build up method of construction.
[Description of Notations]
1 ... Bahia
2 ... Circuit pattern
3 ... Insulating resin
4 ... Copper coat
5 ... Bahia
51 ... Insulating substrate
52 ... Circuit pattern
53 ... Insulating layer
54 ... Bahia formation section
55 ... Bahia
56 ... Circuit pattern
57 ... Insulating layer
58 ... Through tube
59 ... Bahia
60 ... Through hole
61 ... Circuit pattern
62 ... Pattern of a voltage plane
63 ... Solder resist

[Translation done.]

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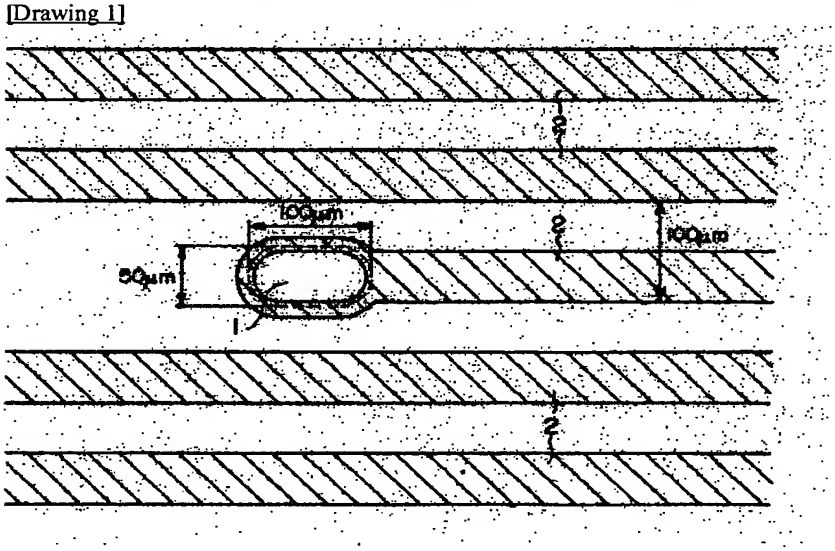
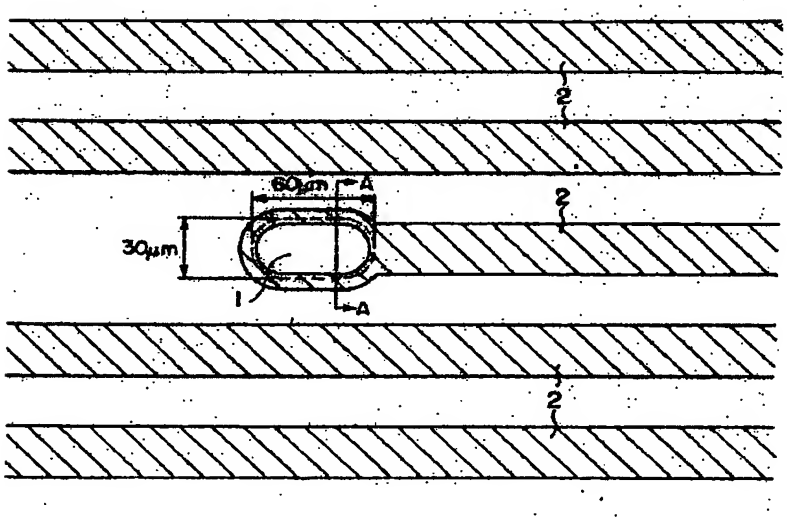
DRAWINGS

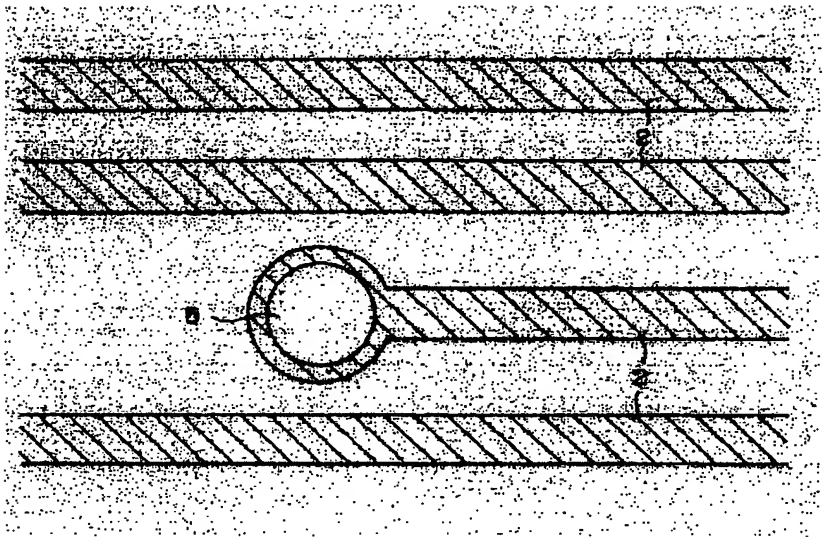
[Drawing 1]



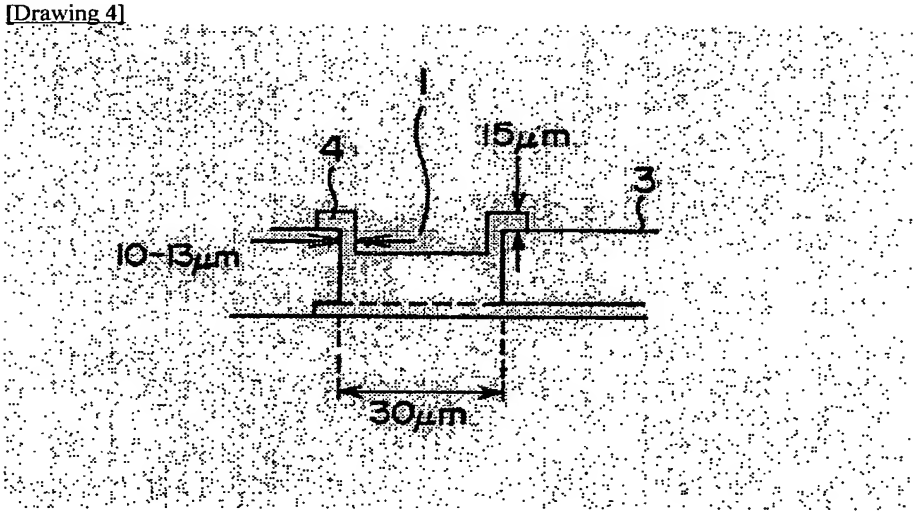
[Drawing 2]



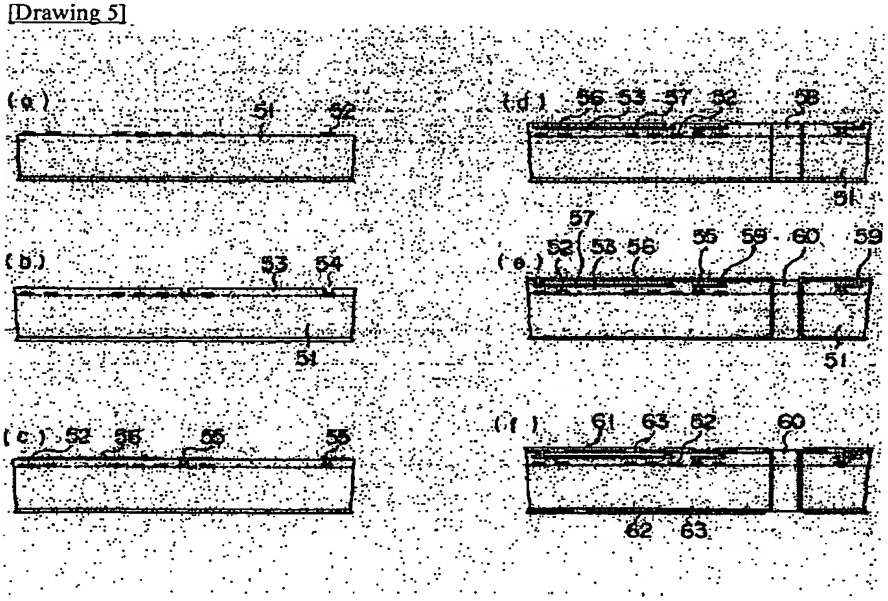
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]